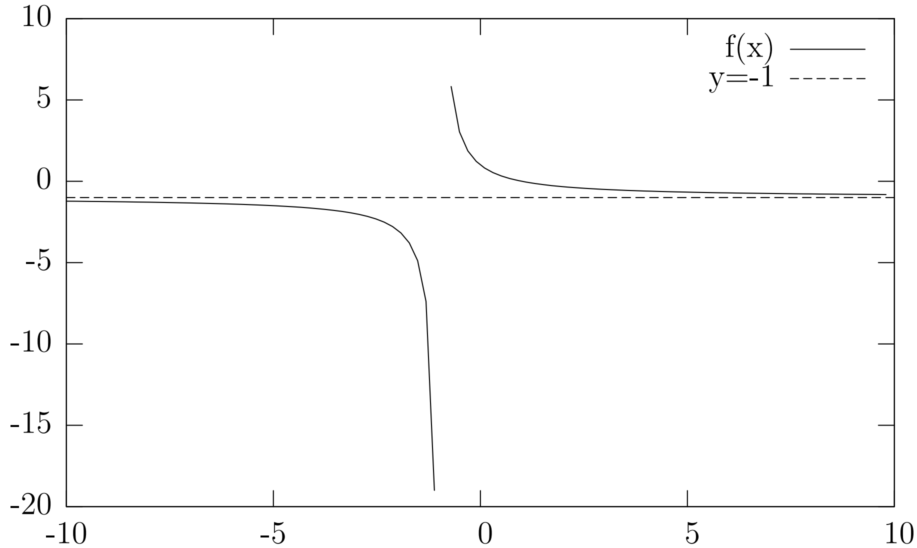
Name ______________________ Student Number ______________

All solutions are to be presented on the paper in the space provided. The quiz is open book. You can discuss the problem with others and ask the TA questions.

(1) Using only the roots and asymptotes, draw the graph of $f(x) = \dfrac{1-x}{1+x}$
There is a vertical asymptote at $x = -1$. $y = -1$ is a horizontal asympotote for both the positive and negative directions. There is a root at $x = 1$. Since this is the only root, the graph will be under the horizontal asymptote when $x < -1$ and above it when $x > -1$.



(2) Let $f(x) = \frac{1-x^2}{1-x}$. Explain, using limits, why $f(x)$ does not have a vertical asymptote at $x = 1$. Remember that $x = 1$ is not in the domain of $f(x)$, so even if $f(x)$ is simplified, it will not make sense to evaluate $f(x)$ at $x = 1$.

$$\lim_{x\to 1} \frac{1-x^2}{1-x} = \lim_{x\to 1}(1+x) = 1.$$

In order to have a vertical asymptote, the limit must not exist and go to either ∞ or $-\infty$. This highlights the importance of *always* checking the limit since it will not always suffice to only look at the denominator.

(3) Find the derivative of $f(x) = \dfrac{2^x x^2 + \frac{\sqrt{x}}{3^x}}{2^x}$

$$f'(x) = \frac{d}{dx}\left(\frac{2^x x^2 + \frac{\sqrt{x}}{3^x}}{2^x}\right) =$$

$$\frac{\frac{d}{dx}(2^x x^2 + \frac{\sqrt{x}}{3^x})2^x - (2^x x^2 + \frac{\sqrt{x}}{3^x})\frac{d}{dx}2^x}{(2^x)^2} =$$

$$\frac{\left(2^x \ln 2 + 2^x 2x + \frac{\frac{1}{2\sqrt{x}}3^x - \sqrt{x}3^x \ln 3}{(3^x)^2}\right)2^x - \left(2^x x^2 + \frac{\sqrt{x}}{3^x}\right)2^x \ln 2}{(2^x)^2}$$